Trabalho 4 – Exercício Tutorial

1)

Pais fumadores (PF) dom(PF) = {T,F}

Fumador(F) dom(F) = {T,F}

Gas\_Radão dom(GR) = {T,F}

Fumador\_Passivo(FP) dom = {T,F}

Cancro\_Pulmão(C) dom(C) = {T,F}

|  |  |
| --- | --- |
| P(PF) | PF |
| T | F |
|  | 0.3 | 0.7 |

|  |  |
| --- | --- |
| P(GR) | GR |
| T | F |
|  | 0.01 | 0.99 |

|  |  |
| --- | --- |
| P(F|PF) | F |
| PF | T | F |
| T | 0.4 | 0.6 |
| F | 0.2 | 0.8 |

|  |  |
| --- | --- |
| P(FP|PF) | FP |
| PF | T | F |
| T | 0.8 | 0.2 |
| F | 0.3 | 0.7 |

|  |  |
| --- | --- |
| P(C|GR,F,FP) | C |
| GR | F | FP | T | F |
| T | T | T | 0.6 | 0.4 |
| T | T | F | 0.4 | 0.6 |
| T | F | T | 0.02 | 0.98 |
| T | F | F | 0.001 | 0.999 |
| F | T | T | 0.06 | 0.94 |
| F | T | F | 0.04 | 0.96 |
| F | F | T | 0.01 | 0.99 |
| F | F | F | 0.0005 | 0.9995 |

Definição:

$$P\left(X1=x\_{1},…,Xn=x\_{n}\right)=P\left(x\_{1},…,x\_{n}\right)= \prod\_{i=1}^{n}P(x\_{i}|parents(Xi))$$

2)

$$P\left(FP=F,PF=F,GR=F\right)=P\left(FP=F|PF=F\right)\*P\left(PF=F\right)\*P\left(GR=F\right)=0.7\*0.7\*0.99= 0.485=48.5\%$$

3)

$$P\left(PF=F,GR=T\right)$$

Seja X, a variável de interrogação

Seja e, o conjunto das variáveis evidência: E1, E2, …, En

Seja y, o conjunto das variáveis ocultas: Y1, Y2, …, Yn

p2

p1

$$P\left(e\right)=<P\left(e\right),P\left(e\right)>$$

$$P\left(e\right)=αP\left(X,e\right)=α\sum\_{y}^{}P\left(X,e,y\right)=α<p1,p2>=(\*\_{2})$$

Genérica:

$$α=\frac{1}{\sum\_{i=1}^{n}P(X=x\_{i})}$$

Do exercício:

$$\left(\*\_{2}\right)=αp1+αp2<=> α=\frac{1}{p1+p2}$$

$$P\left(PF=F,GR=T\right)=>α\sum\_{y}^{}P\left(X,e,y\right)=α[P\left(PF=F\right)\*P\left(GR=T\right)\*\sum\_{F\in \left\{T,F\right\}}^{}P\left(PF=F\right)\*\sum\_{FP\in \left\{T,F\right\}}^{}P\left(PF=F\right)\*P(C|F,FP,GR=T)]$$

Seja C=T

$$P\left(PF=F\right)\*P\left(GR=T\right)\*\left[P\left(PF=F\right)\*\left(P\left(PF=F\right)\*P\left(F=F,FP=F,GR=T\right)+P\left(PF=F\right)\*P\left(F=F,FP=T,GR=T\right)+P\left(PF=F\right)\*\left(P\left(PF=F\right)\*P\left(F=T,FP=F,GR=T\right)+P\left(PF=F\right)\*P\left(F=T,FP=T,GR=T\right)\right)\right]=0.7\*0.01\*\left(0.8(0.7\*0.001+0.3\*0.2\right)+0.2\left(0.7\*0.4+0.3\*0.6\right)\right)=0.007\*\left(0.00536+0.092\right)=0.00068$$

Seja C=F

$$P\left(PF=F\right)\*P\left(GR=T\right)\*\left[P\left(PF=F\right)\*\left(P\left(PF=F\right)\*P\left(F=F,FP=F,GR=T\right)+P\left(PF=F\right)\*P\left(F=F,FP=T,GR=T\right)+P\left(PF=F\right)\*\left(P\left(PF=F\right)\*P\left(F=T,FP=F,GR=T\right)+P\left(PF=F\right)\*P\left(F=T,FP=T,GR=T\right)\right)\right]=0.7\*0.01\*\left(0.8(0.7\*0.999+0.3\*0.8\right)+0.2\left(0.7\*0.6+0.3\*0.4\right)\right)=0.007\*\left(0.7946+0.108\right)=0.0062$$

$$α=\frac{1}{0.00068+0.0062}$$

$$P\left(PF=F,GR=T\right)=\frac{1}{0.00068+0.0062}\*0.00068=0.097=9,7\%$$